Radiation Report on **PA10M (DC: 3B360Q0437)**
Project: AIM

A radiation evaluation was performed on **The PA10M/883 high power, operational amplifier (Apex Microtechnology Corporation)** to determine the total dose tolerance of these parts. The total dose testing was performed using a Co^{60} gamma ray source. During the radiation testing, four devices were irradiated under bias, see figure 1. One part was used as a control sample; the total dose radiation levels were 1, 5, 10, 15, 20, 30, 40 and 50 krads (Si). The average dose rate was 0.06 rads (Si)/sec. After the 50krads (Si) irradiation, the parts were annealed under bias at 25°C for 168 hours. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits listed in Table III. An executive summary of the test results is provided below in bold, followed by a detailed summary of the test results after each radiation level and annealing step.

All irritated devices met the manufacturer's datasheet specifications on all measured parameters up to 40 krads (Si). At 50krads (Si) DUT1 exceeded the datasheet specification of ±30nA of parameters Input offset current and Positive Input Bias Current by –4nA and 2.1nA. the devices recovered after a 168 hour biased room temperature anneal.

Initial electrical measurements were made on 5 samples. Four samples were irradiated (1, 2, 3, 4) and device number C was used as a control sample. All devices had the following external markings on the package: PA10M/883; APEX; 5962-9082801HXA; 3B360Q0437; Δ USA BeO; 60024

All radiated devices passed Initial electrical measurements.
All radiated devices passed electrical measurements at 1, 5, 10, 15, 20, 30, and 40 krads (Si).

At 50krads (Si), one device, DUT1exceeded the manufacturer's datasheet specification of ±30nA of parameters Input offset current and Positive Input Bias Current by 4nA and 2.1nA.

Table IV provides a summary of the test results with the mean and standard deviation values for each parameter after each irradiation exposure and annealing step.

TABLE I. Part Information

Manufacturer's Part Number:	PA10M/883
Full Part Number	5962-9082801HXA
Manufacturer:	Apex Microtechnology Corporation
Lot Date Code (LDC):	3B360Q0437
Quantity Tested:	5
Serial Numbers of Control Sample:	C
Serial Numbers of Radiation Samples:	1, 2, 3, 4,
Part Function:	OPAMP
Part Technology:	Hybrid
Package Style:	8-pin can
Test Equipment:	HP4156B Precision Semiconductor Parameter Analyzer; HP E3611A DC Power Supply
Test Engineer:	J. Forney / A. Pham

- The manufacturer for this part guaranteed no radiation tolerance/hardness.

TABLE II. Radiation Schedule for PA10M

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	7/5/2005
2) 1 KRAD IRRADIATION (0.09 Rads (Si)/SEC)	7/5/2005
POST-1 KRAD ELECTRICAL MEASUREMENT	7/5/2005
3) 5 KRAD IRRADIATION (0.07 Rads (Si)/SEC)	7/6/2005
POST-5 KRAD ELECTRICAL MEASUREMENT	7/6/2005
4) 10 KRAD IRRADIATION (0.06 Rads (Si)/SEC)	7/7/2005
POST-10 KRAD ELECTRICAL MEASUREMENT	7/7/2005
5) 15 KRAD IRRADIATION (0.06 Rads (Si)/SEC)	7/8/2005
POST-15 KRAD ELECTRICAL MEASUREMENT	7/8/2005
6) 20 KRAD IRRADIATION (0.02 Rads (Si)/SEC)	7/11/2005
POST-20 KRAD ELECTRICAL MEASUREMENT	7/11/2005
7) 30 KRAD IRRADIATION (0.10 Rads (Si)/SEC)	7/12/2005
POST-30 KRAD ELECTRICAL MEASUREMENT	7/12/2005
8) 40 KRAD IRRADIATION (0.12 Rads (Si)/SEC)	7/3/2005
POST-40 KRAD ELECTRICAL MEASUREMENT	7/3/2005
9) 50 KRAD IRRADIATION (0.12 Rads (Si)/SEC)	7/14/2005
POST-50 KRAD ELECTRICAL MEASUREMENT	7/14/2005

Average Dose Rate = 0.06 rads (Si)/sec

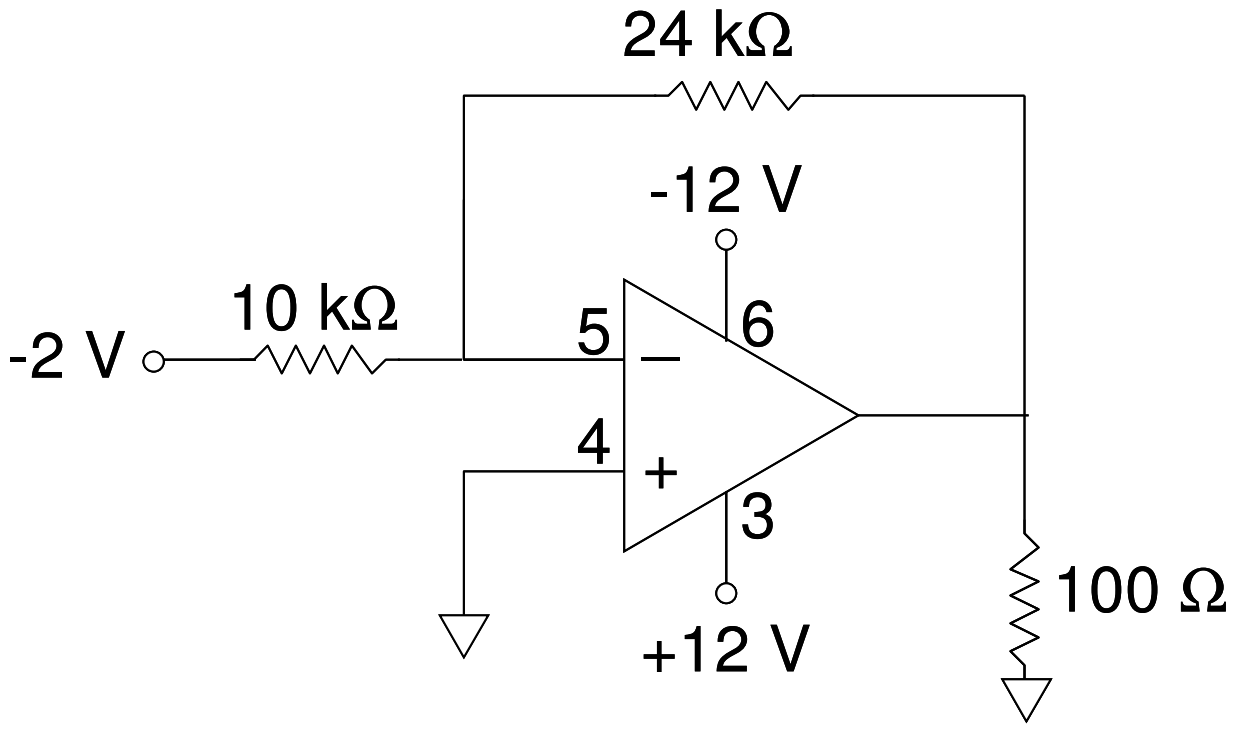

Figure 1. PA10M Bias Circuit

Table III. Electrical Characteristics PA10M

						Total Dose Exposure (kRads Si)																		Annealing	
						Initial		1 krad (Si)		5 krad (Si)		10 krad (Si)		15 krad (Si)		20 krad (Si)		30 krad (Si)		40 krad (Si)		50 krad (Si)		168 hours @25°C	
Test #	Parameters	condition	Units	Spec. Lim. (2) min	Spec. Lim. (2) max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	I-POS	TC = 25°C, Vs = ±40V	mA	8.00	30.00	14.10	7.44E-01	14.00	7.44E-01	13.95	7.90E-01	13.950	7.77E-01	13.85	7.14E-01	13.93	7.89E-01	13.75	7.05E-01	13.83	7.27E-01	13.65	7.90E-01	13.95	6.56E-01
2	I-NEG	TC = 25°C, Vs = ±40V	mA	8.00	30.00	13.85	7.72E-01	14.03	7.85E-01	13.95	7.90E-01	14.050	6.45E-01	13.88	7.54E-01	13.90	6.78E-01	13.75	7.05E-01	13.73	7.89E-01	13.65	7.77E-01	13.60	6.78E-01
3	I-OFFSET	IOS Power = ±40V, VIN = 0V, T = 25°C	nA	--	±30	17.25	4.03E+00	24.25	1.32E+01	13.50	4.65E+00	15.750	6.13E+00	-15.00	6.88E+00	-32.25	1.26E+01	8.50	5.77E-01	-19.00	4.55E+00	-23.75	8.02E+00	-11.25	6.50E+00
4	INP-OFFSET	TC = 25°C,Power = ±40V, VIN = 0V, T = 25°C	mV	--	6.00	2.51	7.17E-01	2.62	7.80E-01	2.55	7.70E-01	2.343	7.91E-01	2.09	7.27E-01	1.95	7.13E-01	1.68	6.62E-01	1.51	6.69E-01	1.39	6.29E-01	1.83	6.54E-01
5	I-BIAS_PLUS	Power = ±40V, VIN = 0V, T = 25°C	nA	--	30.00	3.84	2.98E+00	3.43	3.17E+00	2.18	5.91E+00	4.395	6.35E+00	6.37	6.78E+00	16.38	1.48E+01	11.93	8.04E+00	15.63	8.51E+00	18.20	9.33E+00	12.48	8.28E+00
6	I-BIAS_NEG	Power = ±40V, VIN = 0V, T = 25°C	nA	--	30.00	17.50	1.74E+00	9.25	5.00E-01	10.25	3.20E+00	10.250	3.50E+00	-9.50	4.51E+00	-11.50	6.86E+00	0.25	1.20E+01	-15.00	4.83E+00	20.50	4.65E+00	-8.25	2.50E+00